AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A detector device for detecting incident radiation at particular wavelengths, comprising:

a base layer of material;

a cavity formed on the base layer, the cavity having a pair of reflectors, one being a first reflector layer disposed in fixed relationship with respect to the base layer and the other being a second reflector layer disposed in opposed spaced relationship to the first reflector layer to form a resonant cavity between the reflector layers, the reflectors being disposed a cavity length from each other; and

a detector disposed within the cavity to absorb incident radiation therein for detection purposes,

wherein the detector is further disposed towards one end of the cavity and on ~~adjacent~~ one of the first or second reflector layers,

the second reflector layer is formed on a movable membrane disposed in spaced relationship to the base layer, and

the detector device further comprises a pair of electrodes to control the movement of the membrane.

Claim 2 (Original): A detector device as claimed in claim 1, wherein the first reflector layer and the second reflector layer are disposed in substantially parallel spaced relationship to each other.

Claim 3 (Original): A detector device as claimed in claim 1, wherein the second reflector layer is formed so that at least a portion of it is of slightly concave form with respect to the interior of the cavity.

Claim 4 (Previously Presented): A detector device as claimed in claim 1, wherein the surface of the detector for receiving incident radiation is provided with an anti-reflection (AR) coating to prevent Fresnel reflections therefrom that may otherwise form a complicated coupled multi-cavity structure.

Claim 5 (Previously Presented): A detector device as claimed in claim 1, wherein the detector is formed as an integral part of the reflector structure.

Claim 6 (Previously Presented): A detector device as claimed in claim 1, wherein the base layer comprises an integrated circuit.

Claim 7 (Previously Presented): A detector device as claimed in claim 1, wherein the base layer is a substrate.

Claim 8 (Original): A detector device as claimed in claim 7, wherein the substrate material is a semiconductor or semiconductor system that is transparent to radiation in the wavelengths to be detected by the detector device.

Claim 9 (Previously Presented): A detector device as claimed in claim 1, wherein the cavity length corresponds to optical wavelengths in the infrared region.

Claim 10 (Previously Presented): A detector device as claimed in claim 1, wherein the detector is an active detector layer disposed in juxtaposition with the first reflector layer.

Claim 11 (Currently Amended): A detector device as claimed in claim 1, wherein the ~~second reflector layer is formed on a~~ moveable membrane is ~~disposed in spaced relationship~~

~~to the base layer and~~ suspended relative to the base layer ~~thereto~~ at the periphery of the membrane by a support structure.

Claim 12 (Canceled).

Claim 13 (Currently Amended): A detector device as claimed in claim 1 [[12]], wherein the electrodes are constituted by the reflectors.

Claim 14 (Currently Amended): A detector device as claimed in claim 1 [[12]], wherein the electrodes are juxtaposed with the reflectors, one electrode with the one reflector and the other electrode with the other reflector.

Claim 15 (Previously Presented): A detector device as claimed in claim 11, wherein the first reflector layer and the detector are integrated or integral with the base layer.

Claim 16 (Previously Presented): A detector device as claimed in claim 15, wherein the support structure is mounted upon a further base layer disposed in opposing, spaced relationship to the detector by a support.

Claim 17 (Original): A detector device as claimed in claim 16, wherein the further base layer comprises a readout integrated circuit.

Claim 18 (Previously Presented): A detector device as claimed in claim 17, wherein the support comprises indium bumps that form part of the connection between the readout integrated circuit of the device and the detector.

Claim 19 (Previously Presented): A detector device as claimed in claim 15, wherein the support structure is mounted upon the detector or the base layer of the device.

Claim 20 (Original): A detector device as claimed in claim 19, wherein the first reflector layer is disposed on the surface of the base layer and is embedded between the detector and the base layer.

Claim 21 (Currently Amended): A detector device ~~as claimed in 19~~ for detecting incident radiation at particular wavelengths, comprising:

a base layer of material;

a cavity formed on the base layer, the cavity having a pair of reflectors, one being a first reflector layer disposed in fixed relationship with respect to the base layer and the other being a second reflector layer disposed in opposed spaced relationship to the first reflector layer to form a resonant cavity between the reflector layers, the reflectors being disposed a cavity length from each other; and

a detector disposed within the cavity to absorb incident radiation therein for detection purposes,

wherein the detector is disposed towards one end of the cavity and adjacent one of the first or second reflector layers,

the second reflector layer is formed on a moveable membrane disposed in spaced relationship to the base layer and suspended relative thereto at the periphery of the membrane by a support structure,

the first reflector layer and the detector are integrated or integral with the base layer,

the support structure is mounted upon the detector or the base layer of the device, and

~~wherein~~ the detector together with the first reflector layer is embedded within the base layer ~~substrate~~ on one side thereof so that the detector is exposed on one side of the base layer

~~substrate~~ and the first reflector layer is disposed within the base layer ~~substrate~~ to be integral therewith, and the other side of the base layer ~~substrate~~ having a window therein down to the detector and the first reflector layer to reveal the first reflector layer from the other side of the base layer ~~substrate~~ to enable the passage of radiation therethrough.

Claim 22 (Currently Amended): A detector device ~~as claimed in claim 19~~ for detecting incident radiation at particular wavelengths, comprising:

a base layer of material;

a cavity formed on the base layer, the cavity having a pair of reflectors, one being a first reflector layer disposed in fixed relationship with respect to the base layer and the other being a second reflector layer disposed in opposed spaced relationship to the first reflector layer to form a resonant cavity between the reflector layers, the reflectors being disposed a cavity length from each other; and

a first detector disposed within the cavity to absorb incident radiation therein for detection purposes,

wherein the first detector is disposed towards one end of the cavity and adjacent one of the first or second reflector layers,

the second reflector layer is formed on a moveable membrane disposed in spaced relationship to the base layer and suspended relative thereto at the periphery of the membrane by a support structure,

the first reflector layer and the first detector are integrated or integral with the base layer,

the support structure is mounted upon the first detector or the base layer of the device, and

~~wherein~~ the first reflector layer is ~~preferred to be~~ disposed on another detector having a different wavelength sensitivity to incident radiation than the first detector, so that the first reflector layer is interposed between the two detectors, and the other detector is disposed on the base layer.

Claim 23 (Original): A detector device as claimed in claim 22, wherein the other detector is of a shorter wavelength sensitivity to incident radiation to be detected than the first detector, and the base layer is a substrate.

Claim 24 (Previously Presented): A detector device as claimed in claim 22, including another reflector layer juxtaposed with the base layer, and interposed between the other detector and the base layer, to define another cavity between the second reflector layer and the other reflector layer, the cavities being conjunctively tunable by moving the membrane of the second reflector layer.

Claim 25 (Original): A detector device as claimed in claim 24, wherein the other detector is of a longer wavelength sensitivity to incident radiation to be detected than the first detector.

Claim 26 (Currently Amended): A detector device as claimed in claim 11, wherein the first reflector layer and the detector are ~~preferably~~ separate from the base layer, whereby the second reflector layer and the moveable membrane are interposed between the detector and the base layer.

Claim 27 (Currently Amended): A detector device as claimed in claim 26 [[28]], wherein the detector forms part of a homogeneous layer of material having the first reflector juxtaposed on one side thereof, distal from the base layer, and the second reflector juxtaposed on the other side thereof, proximal to the base layer, whereby a recess is formed within the homogeneous layer of material adjacent to the second reflector layer to form an air gap within the cavity, and the detector is defined by the residual homogeneous layer of material disposed between the recess and the first reflector layer.

Claim 28 (Currently Amended): A detector device as claimed in claim 11, wherein the membrane and one reflector are [[is]] shaped in accordance with a prescribed membrane geometry.

Claim 29 (Currently Amended): A detector device as claimed in claim 11, wherein the displacement of the suspended moveable membrane can be up to the full length of the air gap provided in the cavity, but is adjusted to avoid the membrane contacting the reflector, the detector or a [[the]] readout integrated circuit, depending upon the particular detector arrangement.

Claim 30 (Previously Presented): A detector device as claimed in claim 11, wherein the membrane is formed of silicon nitride.

Claim 31 (Previously Presented): A detector device as claimed in claim 11, wherein the support structures are formed of zinc sulphide.

Claim 32 (Previously Presented): A detector device as claimed in claim 1, wherein the base layer is formed from an infrared sensitive material.

Claim 33 (Original): A detector device as claimed in claim 32, wherein the infrared sensitive material is mercury cadmium telluride (MCT).

Claim 34 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths, the method including:

providing a base layer of material;

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes,

wherein the detector is formed towards one end of the cavity and on ~~adjacent~~ one of the or the other ~~second~~ reflector ~~layers~~,

the other reflector is formed on a moveable membrane disposed in spaced relationship to the base layer, and

the method further comprises forming a pair of electrodes to control the movement of the membrane.

Claim 35 (Original): A method as claimed in claim 34, including disposing the one reflector and the other reflector in substantially parallel spaced relationship to each other.

Claim 36 (Original): A method as claimed in claim 34, including forming the other reflector so that at least a portion of it is of slightly concave form with respect to the interior of the cavity.

Claim 37 (Previously Presented): A method as claimed in claim 34, including coating the surface of the detector that receives incident radiation with an anti-reflection (AR) coating to prevent Fresnel reflections therefrom that may otherwise form a complicated coupled multi-cavity structure.

Claim 38 (Previously Presented): A method as claimed in claim 34, including forming the detector as an integral part of the reflector structure.

Claim 39 (Previously Presented): A method as claimed in claim 34, wherein the base layer comprises an integrated circuit.

Claim 40 (Previously Presented): A method as claimed in claim 34, wherein the base layer is a substrate.

Claim 41 (Currently Amended): A method as claimed in claim 40, wherein the substrate ~~material~~ is a semiconductor or semiconductor system that is transparent to radiation in the wavelengths to be detected by the detector device.

Claim 42 (Previously Presented): A method as claimed in claim 34, wherein the cavity length corresponds to optical wavelengths in the infrared region.

Claim 43 (Currently Amended): A method as claimed in claim 34, including:

forming the [[a]] moveable membrane;

suspending the membrane at the periphery thereof with a support structure so that it is disposed in spaced relationship to the base layer;

forming the other reflector on the moveable membrane; and

providing a pair of electrodes to control the movement of the membrane.

Claim 44 (Original): A method as claimed in claim 43, wherein the electrodes are constituted by the reflectors.

Claim 45 (Original): A method as claimed in claim 43, wherein the electrodes are juxtaposed with the reflectors, one electrode with the one reflector and the other electrode with the other reflector.

Claim 46 (Previously Presented): A method as claimed in claim 34, including forming the one reflector and the detector so that they are integrated or integral with the base layer.

Claim 47 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths ~~as claimed in claim 46~~, the method including:

providing a base layer of material

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the detector is formed towards one end of the cavity and adjacent one of the one or the other reflector,

wherein the method further comprises:

forming the one reflector and the detector so that they are integrated or integral with the base layer;

growing a first reflector layer on the base layer to form the one reflector of the cavity resonator;

growing an active detector layer on the one reflector to form one side of the detector device;

forming a second reflector layer on a further base layer to form the other reflector of the cavity resonator and the other side of the detector device;

conjoining the sides of the detector device relative to each other so that the one reflector is disposed in confronting relationship with the other reflector and the reflectors are spaced apart, with the detector disposed therebetween; and

bonding the two sides together to form an integral detector device with the reflectors disposed in spaced apart relationship to each other to form the resonant cavity with the detector disposed therein.

Claim 48 (Previously Presented): A method as claimed in claim 47, including forming a support on one side or the other of the detector device to space the reflectors apart when conjoining one side relative to the other.

Claim 49 (Previously Presented): A method as claimed in claim 47, wherein the further base layer comprises a readout integrated circuit.

Claim 50 (Previously Presented): A method as claimed in claim 48, including forming the support from indium bumps.

Claim 51 (Previously Presented): A method as claimed in claim 47, wherein the conjoining and bonding involve a flip-chip bonding process.

Claim 52 (Previously Presented): A method as claimed in claim 47, including epitaxially growing the one reflector as a wide bandgap dielectric stack prior to growing the active detector layer or layers.

Claim 53 (Original): A method as claimed in claim 52, wherein the one reflector is an MCT/cadmium telluride (CdTe) $\lambda/4$ dielectric stack.

Claim 54 (Previously Presented): A method as claimed in claim 47, including suspending the other reflector upon the further base layer.

Claim 55 (Previously Presented): A method as claimed in claim 47, including forming the other reflector on, or as, a moveable membrane disposed in opposing, spaced relationship to the further base layer and suspended relative thereto at the periphery of the membrane by a support structure.

Claim 56 (Original): A method as claimed in claim 46, including forming the membrane so that it is suspended by a support structure mounted upon the detector or base layer of the device.

Claim 57 (Original): A method as claimed in claim 56, including growing a first reflector layer on the surface of the base layer to constitute the one reflector, and depositing the detector thereon so that the first reflector layer is embedded between the base layer and the detector.

Claim 58 (Currently Amended): A method <u>for fabricating a detector device for detecting incident radiation at particular wavelengths</u> ~~as claimed in claim 56,~~ <u>the method</u> including:

<u>providing a base layer of material;</u>

<u>forming one reflector in fixed relationship with respect to the base layer;</u>

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other, and

forming a detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the detector is formed towards one end of the cavity and adjacent one of the one or other reflector,

wherein the method further comprises:

forming the one reflector and the detector so that they are integrated or integral with the base layer;

forming the membrane so that it is suspended by a support structure mounted upon the detector or base layer of the device;

embedding the detector in one side of the base layer;

etching a window in the base layer from the other side thereof down to the detector to reveal the rear thereof;

depositing a first reflector layer on the rear of the detector to form the one reflector of the cavity resonator; and

forming a second reflector layer disposed in opposing relationship to the base layer to form the other reflector of the cavity resonator.

Claim 59 (Original): A method as claimed in claim 58, including suspending the other reflector upon the base layer.

Claim 60 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths ~~as claimed in claim 56~~, the method including:

providing a base layer of material;

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a first detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the first detector is formed towards one end of the cavity and adjacent one of the one or the other reflector,

wherein the method further comprises:

forming the one reflector and the first detector so that they are integrated or integral with the base layer;

forming the membrane so that it is suspended by a support structure mounted upon the first detector or base layer of the device;

depositing another detector on the base layer;

growing a first reflector layer on the other detector to form the one reflector of the cavity resonator;

depositing the first detector on the first reflector layer and the other detector so that the first reflector layer is interposed between the two detectors; and

forming a second reflector layer in opposing, spaced relationship to the first detector to form the other reflector of the cavity resonator;

wherein the other detector has a different wavelength sensitivity to incident radiation than the first detector.

Claim 61 (Original): A method as claimed in claim 60, wherein the other detector is of a shorter wavelength sensitivity to incident radiation to be detected than the first detector, and the base layer is a substrate.

Claim 62 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths ~~as claimed in claim 56~~, the method including:

providing a base layer of material;

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a first detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the first detector is formed towards one end of the cavity and adjacent one of the one or the other reflector,

wherein the method further comprises:

forming the one reflector and the first detector so that they are integrated or integral with the base layer;

forming the membrane so that it is suspended by a support structure mounted upon the first detector or base layer of the device;

growing another reflector layer on the base layer to form a further reflector of a second resonator cavity within the device;

depositing [[a]] another detector on the other reflector layer so that the other reflector layer is interposed between the other detector and the base layer;

growing a first reflector layer on the other detector to form the one reflector of the first resonant cavity within the device;

depositing the first detector on the first reflector layer and the other detector so that the first reflector layer is interposed between the first detector and the other detector; and

forming a second reflector layer in opposing, spaced relationship to the first detector to form the other reflector of both cavity resonators;

wherein one cavity is defined between the first reflector layer and the second reflector layer, and another cavity is defined between the other reflector layer and the second reflector layer.

Claim 63 (Currently Amended): A method as claimed in claim 60 [[64]], wherein the other detector is of a longer wavelength sensitivity to incident radiation to be detected than the first detector.

Claim 64 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths ~~as claimed in claim 34~~, the method including:

providing a base layer of material;

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the detector is formed towards one end of the cavity and adjacent one of the one or the other reflector,

wherein the method further comprises:

forming: (i) a first reflector layer upon one side of a layer of homogeneous material sensitive to the incident radiation at the wavelength(s) to be detected to form the one reflector of the resonant cavity; and (ii) the detector within the layer of homogeneous material with an air gap to expose the detector to the other side of the homogeneous material; the first reflector layer and the detector being formed discretely from the base layer to constitute a first half of the device;

forming: (i) the moveable membrane; and (ii) a second reflector layer to form the other reflector of the resonant cavity thereon; on the base layer so that the second reflector layer, the moveable membrane and the base layer constitute a second half of the device discrete from the first half of the device; and

conjoining the first half and the second half of the device so that the second reflector layer is juxtaposed and bonded to the other side of the layer of homogeneous material;

whereby the second reflector layer and the moveable membrane surmounts the air gap and the detector to form the cavity with the detector disposed therein.

Claim 65 (Original): A method as claimed in claim 64, including:

growing the first reflector layer on one side of the layer of homogeneous material to be distal from the base layer in the end device;

etching the other side of the layer to form a recess that constitutes the air gap of the resultant cavity, the residual material disposed between the recess and the first reflector layer defining the detector; and

juxtaposing the second reflector layer on the other side of the layer of homogeneous material so that it is proximal to the base layer.

Claim 66 (Currently Amended): A method for fabricating a detector device for detecting incident radiation at particular wavelengths ~~as claimed in claim 34~~, the method including:

providing a base layer of material;

forming one reflector in fixed relationship with respect to the base layer;

forming another reflector in opposed spaced relation to the one reflector so as to form a resonant cavity between the pair of reflectors, the reflectors being disposed a cavity length from each other; and

forming a detector to be disposed within the cavity for absorbing incident radiation therein for detection purposes, wherein the detector is formed towards one end of the cavity and adjacent one of the one or the other reflector,

wherein the method further comprises:

forming a sacrificial layer of a prescribed material on the base layer, the material having a high etch selectivity for releasing the membrane in a suspended and spaced relationship from the base layer, as appropriate;

forming the membrane on the sacrificial layer using a deposition technique characterised by providing the required intrinsic stress in the membrane;

depositing the second reflector layer on the membrane to form the other reflector;

patterning the further layer in accordance with a prescribed membrane geometry;

etching the second reflector layer to achieve the prescribed membrane geometry;

initially etching the sacrificial layer to remove regions thereof down to the base layer, as appropriate, exposed by the etching;

protecting those regions of the sacrificial layer intended to function as the residual support structure of the membrane; and

finally etching the remaining unprotected regions of the sacrificial layer and removing the protection from the support structures to suspend the membrane in spaced relation to the base layer.

Claim 67 (Original): A method as claimed in claim 66, wherein the membrane is formed of silicon nitride.

Claim 68 (Previously Presented): A method as claimed in claim 66, wherein the sacrificial layer is formed of zinc sulphide.

Claim 69 (Previously Presented): A method as claimed in claim 66, wherein the base layer is a substrate formed from an infrared sensitive material.

Claim 70 (Previously Presented): A method as claimed in claim 66, wherein the base layer is a readout substrate formed of silicon.

Claim 71 (Previously Presented): A method as claimed in claim 66, wherein the deposition technique for forming the membrane is plasma enhanced chemical vapour deposition (PECVD).

Claim 72 (Previously Presented): A method as claimed in claim 66, wherein the second reflector layer is etched using an anisotropic etching process.

Claim 73 (Original): A method as claimed in claim 72, wherein the anisotropic etching process for the second reflector layer involves dry etching.

Claim 74 (Original): A method as claimed in claim 73, wherein the dry etching involves plasma etching.

Claim 75 (Original): A method as claimed in claim 74, wherein the plasma etching is reactive ion etching.

Claim 76 (Previously Presented): A method as claimed in claim 66, wherein the sacrificial layer is initially etched using an anisotropic etching process.

Claim 77 (Original): A method as claimed in claim 76, wherein the anisotropic etching process for initially etching the sacrificial layer involves dry etching.

Claim 78 (Previously Presented): A method as claimed in claim 66, wherein the protection of the support structures is provided by photoresist.

Claim 79 (Previously Presented): A method as claimed in claim 66, wherein the remaining unprotected regions of the sacrificial layer are finally etched using an isotropic etching process.

Claim 80 (Original): A method as claimed in claim 79, wherein the isotropic etching process involves a final release wet etch that undercuts the remaining membrane.

Claim 81 (Previously Presented): A detector device for detecting incident radiation at particular wavelengths fabricated according to the method as claimed in claim 34.

Claims 82 and 83 (Canceled).